

Fabrication of the first French spoke prototype

Jean Lesrel for the



cavity group

RF parameters



Frequency **358.66 MHz**

Q_0 @ 4K **$1.9 \cdot 10^9$**

r/Q_0 **220 Ω**

G **101 Ω**

E_{pk}/E_{acc} **3.06**

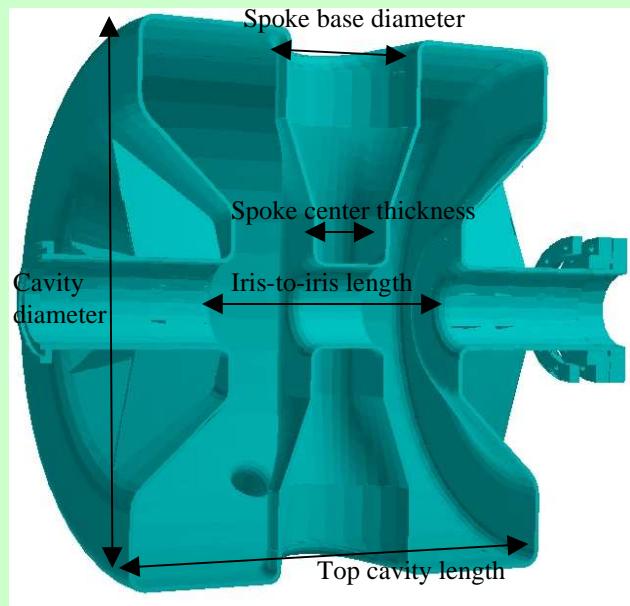
B_{pk}/E_{acc} **8.28 mT/MV/m**

AMANDA

$\beta = 0.35$

Optimum beta **0.363**

Dimensions



Main dimensions (in mm)

Cavity diameter	408
Top cavity length	354
Spoke base diameter	118
Spoke center thickness	67
Spoke center width	147
Gap-center to gap-center length	150
Iris-to-iris length	200
Tube length (from iris to flange)	150
Beam tube aperture	60

Companies

Niobium:

TOKYO DENKAI (Japan)

RRR 250

thickness: 3 mm

Cavity fabrication : CERCA (France)

Fabrication time: 5 months



Subcontractors:

Spinning : BONITEMPO (France)

Machining : PRECISION MECANIQUE DUC (France)

Electron Beam Welding Machine



Vacuum $< 10^{-5}$ mbar

Diameter 1.5 m

Length 4.5 m

Beam power 6 kW

Before welding

Chemical cleaning

degreasing

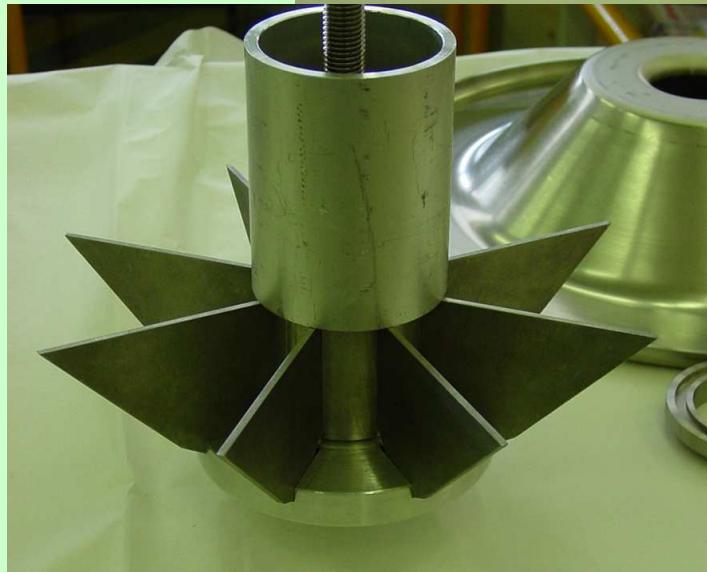
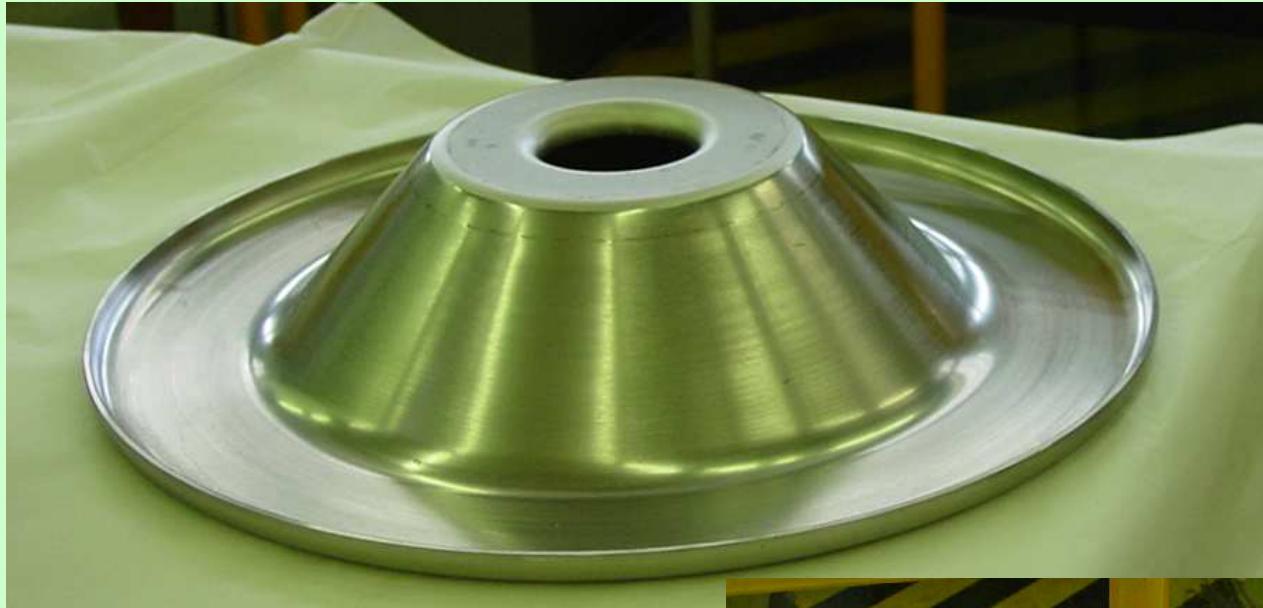
rinsing

Drying under Nitrogen atm.

Fabrication method (cylinders and flanges)



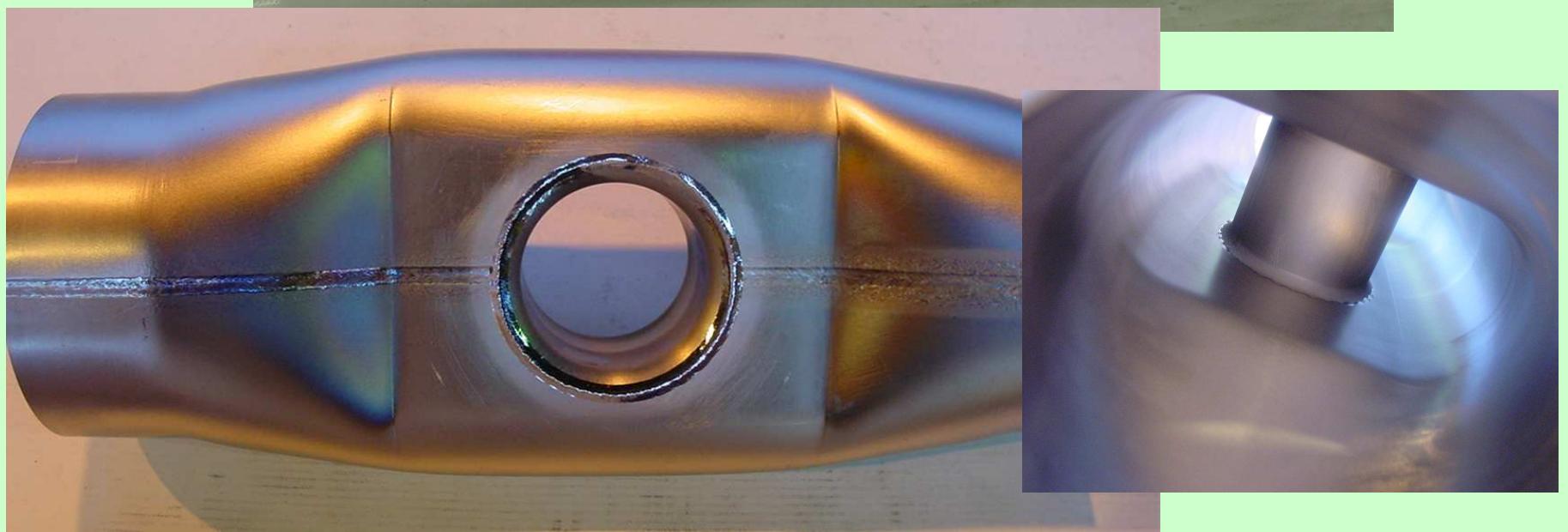
Fabrication method (walls and stiffeners)



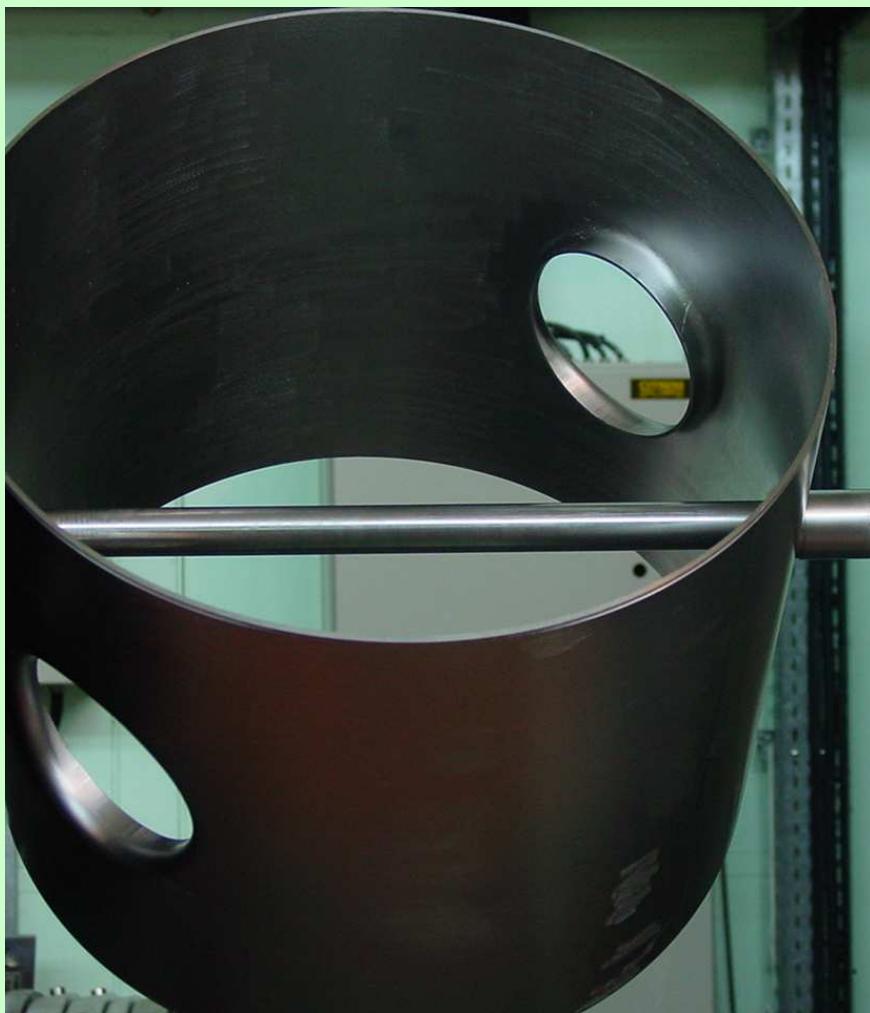
Fabrication method (walls and stiffeners)



Fabrication method (**spoke bar**)



Fabrication method (**cavity body**)



Fabrication method (final assembly)



Dimension control

	calculated sensitivity	dimension	measured	frequency variation
Cavity diameter	-950 kHz/mm	414 ± 0.2	413.9	+ 95 kHz
Spoke base diameter	+650 kHz/mm	118 ± 0.1	117.8	- 130 kHz
spoke center width	-800 kHz/mm	147 ± 0.2	146.8	-160 kHz
Spoke center thickness	-600 kHz/mm	67 ± 0.1	67.2	+ 120 kHz
top cavity length	+450 kHz/mm	360 ± 0.5	361	+ 450 kHz
Total				+375 kHz

Calculated frequency : **358.55 MHz**

Measured frequency : **358.85 MHz**

$\Delta f = 300 \text{ kHz}$

Mechanical tests at room temperature



Tuning sensitivity: 500 kHz/mm

Structure spring constant: 2600 N/mm

Frequency variation under vacuum:
 100 kHz

Frequency variation at 4 K:
in November